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Lighter actinides, new high pressure results

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Investigation of crystal structural changes in actinides to multi-megabar pressures at room temperature is now possible using diamond-anvil cell. Experimental work on thorium has shown that the ambient fcc structure transforms to a bct structure and is stable to 300 GPa. Uranium on the other hand does not go through a structural change even at 100 GPa pressure. In contrast, Np changes from an orthorhombic structure at ambient to a possible lower symmetry (bcm or bct?) structure and then ultimately to a bcc phase. From our studies we conclude that the ultimate crystal structure for lighter actinides could be a bcc phase, however, this room temperature-high pressure bcc phase is different from the high temperature-low pressure phase before melting reported in literature.

Theoretical prediction of structural changes in the case of thorium and neptunium reasonably agrees with the experimental data. Contrary to the earlier theoretical reports, recent calculations done by Söderlind and Wills[1] do not predict any structural change in uranium up to 100 GPa, which is in agreement with the experimental data of Akella and Weir.

[1]J. Akella, J. M. Wills and P. Söderlind, Phys. Rev. Lett. (submitted)

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